Docket 83025JDP
Customer No. 01333

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of	Group Art Unit: 2624 Confirmation No. 8281
Jiebo Luo, et al.	Examiner: James A. Thompson
DIGITAL IMAGE MULTITONING METHOD	
Serial No. 09/896,798	
Filed 29 June 2001	

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Commissioner for Patents
P.O. Box 1450
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Sir:

APPEAL BRIEF PURSUANT TO 37 C.F.R. 41.37 and 35 U.S.C. 134

I. Table Of Contents

APPELLANT'S BRIEF ON APPEAL

Appellants hereby appeal to the Board of Patent Appeals and Interferences from the Examiner's Final Rejection of claims 16 and 18-26 which was contained in the Office Action mailed May 30, 2007.

A timely Notice of Appeal was filed August 30, 2007.

II. Real Party In Interest

Eastman Kodak Company is the real party in interest.

III. Related Appeals And Interferences

No appeals or interferences are known which will directly affect or be directly affected by or have bearing on the Board's decision in the pending appeal.

IV. Status Of The Claims

Claims 1-15 and 17 have been cancelled pursuant to appellant's response mailed March 6, 2007. Claims 16 and 18-26 stand finally rejected and are the subject of this appeal.

Appendix I provides a clean, double spaced copy of the claims on appeal.

V. Status Of Amendments

No amendments to the claims were made after the final rejection. Remarks were made, however, by Appellants in a Response After Final filed July 27, 2007. An Advisory Action mailed August 6, 2007 indicated that such remarks did not place this application in condition for allowance.

VI. Summary of Claimed Subject Matter

Independent claim 16 reads as follows:

16. A method for multitone processing an N level digital image to produce an M level digital image (pg. 3, lines 11-13) wherein M and N have unchanging values (pg. 5, lines 4-5; pg. 6, lines 16-18), (pg. 4, lines 18-20) and M<N (pg. 3, line 13), comprising the steps of:

clustering all of the pixel values of the N level image into M reconstruction levels based on the gray level distribution (pg. 3, lines 13-14) of the N level image, wherein the clustering produces K clusters of pixel values, and wherein K=M (pg. 4, line 18 to pg. 5, line 5);

repeatedly revising said K clusters of pixel values until error between the N level digital image and the M level digital image is minimized (pg. 4, line 24 to pg. 5, line 3; Fig. 2, refs. 23-25), wherein throughout the repeated revising of said K clusters, the number of clusters K does not change (pg. 5, lines 4-5; pg. 6, lines 16-18); (pg. 4, lines 22-23);

applying multilevel error diffusion to the N level digital image using said M reconstruction levels to produce the M level digital image (pg. 5, lines 16-24; Fig. 1, ref. 13); and

applying said M level digital image to an image output device ("Background" generally pg. 1, line 9 to pg. 3, line 8 which discusses the problems solved by the claimed invention in image output devices, such as printing devices; Fig. 1, ref. 14).

Independent claim 21 reads as follows:

21. A method for multitone processing an N level digital image to produce an M level digital image (pg. 3, lines 11-13) wherein M and N have unchanging values (pg. 5, lines 4-5; pg. 6, lines 16-18), (pg. 4, lines 18-20) and M<N (pg. 3, line 13), comprising the steps of:

setting initial values of M cluster centers (pg. 4, lines 21-24; Fig. 2, ref. 22);

assigning pixels of the N level digital image to said cluster centers to provide assigned pixels (pg. 4, lines 24-26; Fig. 2, ref. 23);

calculating new values of said cluster centers based upon respective said assigned pixels (pg. 4, lines 26-28; Fig. 2, ref. 24);

repeating said assigning and calculating until a predetermined stopping condition is reached and, thereby, final values of said cluster centers are defined (pg. 4, line 30 to pg. 5, line 2; Fig. 2, ref. 25);

selecting said final values of said cluster centers as reconstruction levels (pg. 5, lines 4-5);

applying multilevel error diffusion to the N level digital image using said reconstruction levels to produce the M level digital image (pg. 5, lines 16-24; Fig. 1, ref. 13); and

applying said M level digital image to an image output device ("Background" generally pg. 1, line 9 to pg. 3, line 8 which discusses the problems solved by the claimed invention in image output devices, such as printing devices; Fig. 1, ref. 14).

VII. Grounds of Rejection to be Reviewed on Appeal

The following issues are presented for review by the Board of Patent Appeals and Interferences:

1. Claims 16 and 21-23 stand rejected under 35 U.S.C. §103(a) as allegedly unpatentable over U.S. Patent No. 5,936,684 (Murayama) in view of U.S. Patent No. 5,649,025 (Revankar).
2. Claims 18 and 24 stand rejected under 35 U.S.C. §103(a) as allegedly unpatentable over U.S. Patent No. 5,936,684 (Murayama) in view of U.S. Patent No. 5,649,025 (Revankar) and further in view of U.S. Patent No. 6,501,566 (Ishiguro).
3. Claim 19 stands rejected under 35 U.S.C. §103(a) as allegedly unpatentable over U.S. Patent No. 5,936,684 (Murayama) in view of U.S. Patent No. 5,649,025 (Revankar) and further in view of U.S. Patent No. 4,945,478 (Merickel) and in view of 5,565,994 (Eschbach).
4. Claim 20 stands rejected under 35 U.S.C. §103(a) as allegedly unpatentable over U.S. Patent No. 5,936,684 (Murayama) in view of U.S. Patent No. 5,649,025 (Revankar), and further in view of U.S. Patent No. 4,945,478 (Merickel) and in view of 5,565,994 (Eschbach) and lastly in view of U.S. Patent No. 5,621,546 (Klassen).
5. Claim 25 stands rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,936,684 (Murayama) in view of U.S. Patent No. 5,649,025 (Revankar) and further in view of U.S. Patent No. 5,565,994 (Eschbach).
6. Claim 26 stands rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,936,684 (Murayama) in view of U.S. Patent No. 5,649,025 (Revankar) and further in view of U.S. Patent No. 5,565,994 (Eschbach) and lastly in view of U.S. Patent No. 5,621,546 (Klassen).

VIII. Arguments

Applicants respectfully submit that the claims are patentable over the rejecting references taken separately or in any proper combination for at least the following reasons.

1. The rejections of Claims 16 and 21-23 under 35 U.S.C. §103(a) as allegedly unpatentable over U.S. Patent No. 5,936,684 (Murayama) in view of U.S. Patent No. 5,649,025 (Revankar)

Independent Claim 16 requires, among other things, repeatedly revising K clusters of pixel values ... until error is minimized. Throughout the repeated revising of the K clusters, the number of clusters K does not change, i.e., K remains constant. For purposes of illustration, Appellants will refer to these features herein as "repeatedly revising a constant number of clusters K".

The Examiner states that the primary rejecting reference, Murayama, teaches a constant number of clusters K, and does not teach repeated revising of its K clusters. See the first full paragraph and the third full paragraph on page 3 of the Final Office Action (stating that "Murayama ... discloses that the number of clusters K is set constant" and "Murayama does not disclose expressly repeatedly revising said K clusters ....").

To supplement Murayama's missing teaching of repeatedly revising its constant number of clusters, the Examiner relies upon the Revankar Patent. However, the Revankar Patent teaches repeatedly revising a changing number of clusters. In particular, the Revankar Patent is understood to incrementally generate a plurality of thresholds (which are apparently referred to by the Final Office Action at page 3, fourth full paragraph as corresponding to or being used to generate 'clusters' of pixel values) as part of its recursive thresholding processes 204, 206. See col. 5, lines 6-15 and col. 6, lines 25-31. Of the plurality of thresholds generated by recursion, the Revankar Patent is understood to teach selecting a subset of thresholds meeting 'goodness' criteria.

See col. 5, lines 16-40. Accordingly, Appellants understand the Revankar Patent's recursive threshold generation process to incrementally increase the number of 'clusters' and then decrease them during its selection of only a subset of the 'best' 'clusters' Consequently, the Revankar Patent's repeated revising is understood to involve a changing number of clusters and not a constant number of 'clusters.'

Without any support from the Revankar Patent or otherwise, the Examiner eliminates Revankar's teaching of changing its number of 'clusters' during its repeated revising, and desires only to import Revankar's 'repeated revising' into the Murayama Patent. In other words, even though the Revankar Patent teaches repeatedly revising a changing number of 'clusters,' the Examiner desires to interpret the Revankar Patent as only teaching 'repeated revising'. The Examiner has not provided any evidence to support this interpretation, and, without such evidence, it appears that the Examiner is merely relying upon hindsight to interpret the Revankar Patent in this manner. How would one of ordinary skill in the art, reading Revankar's teaching of repeatedly revising a changing number of 'clusters,' know how to or have any reason to modify the Murayama Patent to include repeated revising of a constant number of clusters?

For at least these reasons, Appellants respectfully request reversal of the 35 U.S.C. §103(a) rejection of Claim 16.

Independent Claim 21 includes the same or similar features as those discussed above in connection with Claim 16 and, therefore, are submitted to be patentable for at least the same reasons. In particular, Claim 21 requires "M cluster centers", where "M" is an unchanging value. Consequently, the "M cluster centers" are a constant number of cluster centers, similar to that discussed above with respect to Claim 16. Further, Claim 21 requires that "new values of said cluster centers" be repeatedly calculated. Accordingly, Claim 21 requires repeated revising of the M cluster centers, similar to that discussed above with respect to Claim 16. Therefore, Appellants respectfully request reversal of the 35 U.S.C. §103(a) rejection of Claim 21 for at least the same reasons set forth above with respect to Claim 16.

Claims 22 and 23 depend from Claim 21 and, therefore, are submitted to be patentable for at least the same reasons. Accordingly, Appellants respectfully request reversal of the 35 U.S.C. §103(a) rejections of Claims 22 and 23.

2. The rejections of Claims 18 and 24 under 35 U.S.C. §103(a) as allegedly unpatentable over U.S. Patent No. 5,936,684 (Murayama) in view of U.S. Patent No. 5,649,025 (Revankar) and further in view of U.S. Patent No. 6,501,566 (Ishiguro)

Claim 18 depends from Claim 16 and, therefore, is submitted to be patentable for at least the same reasons as Claim 16 set forth above. Claim 24 depends from Claim 21 and, therefore, is submitted to be patentable for at least the same reasons as Claim 21 set forth above. Accordingly, Appellants respectfully request reversal of the 35 U.S.C. §103(a) rejection of Claims 18 and 24.

3. Claim 19 stands rejected under 35 U.S.C. §103(a) as allegedly unpatentable over U.S. Patent No. 5,936,684 (Murayama) in view of U.S. Patent No. 5,649,025 (Revankar) and further in view of U.S. Patent No. 4,945,478 (Merickel) and in view of 5,565,994 (Eschbach)

Claim 19 depends from Claim 16 and, therefore, is submitted to be patentable for at least the same reasons as Claim 16 set forth above. Accordingly, Appellants respectfully request reversal of the 35 U.S.C. §103(a) rejection of Claim 19.

4. Claim 20 stands rejected under 35 U.S.C. §103(a) as allegedly unpatentable over U.S. Patent No. 5,936,684 (Murayama) in view of U.S. Patent No. 5,649,025 (Revankar), and further in view of U.S. Patent No. 4,945,478 (Merickel) and in view of 5,565,994 (Eschbach) and lastly in view of U.S. Patent No. 5,621,546 (Klassen)

Claim 20 depends from Claim 16 and, therefore, is submitted to be patentable for at least the same reasons as Claim 16 set forth above. Accordingly, Appellants respectfully request reversal of the 35 U.S.C. §103(a) rejection of Claim 20.

5. Claim 25 stands rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,936,684 (Murayama) in view of U.S. Patent No. 5,649,025 (Revankar) and further in view of U.S. Patent No. 5,565,994 (Eschbach)

Claim 25 depends from Claim 21 and, therefore, is submitted to be patentable for at least the same reasons as Claim 21 set forth above. Accordingly, Appellants respectfully request reversal of the 35 U.S.C. §103(a) rejection of Claim 25.

6. Claim 26 stands rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,936,684 (Murayama) in view of U.S. Patent No. 5,649,025 (Revankar) and further in view of U.S. Patent No. 5,565,994 (Eschbach) and lastly in view of U.S. Patent No. 5,621,546 (Klassen)

Claim 26 depends from Claim 21 and, therefore, is submitted to be patentable for at least the same reasons as Claim 21 set forth above. Accordingly, Appellants respectfully request reversal of the 35 U.S.C. §103(a) rejection of Claim 26.

IX. Summary

For at least the above reasons, Appellants respectfully submit that the rejections set forth in the Final Office Action are improper.

X. Conclusion

For at least the above reasons, Appellants respectfully request that the Board of Patent Appeals and Interferences reverse the rejection by the Examiner and mandate the allowance of Claims 16, and 18-26.

Respectfully submitted,

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Enclosures

If the Examiner is unable to reach the Applicant(s) Attorney at the telephone number provided, the Examiner is requested to communicate with Eastman Kodak Company Patent Operations at (585) 477-4656.

Appendix I - Claims on Appeal

1. – 15. (Cancelled)

16. (Previously Presented) A method for multitone processing an N level digital image to produce an M level digital image wherein M and N have unchanging values and M<N, comprising the steps of:

clustering all of the pixel values of the N level image into M reconstruction levels based on the gray level distribution of the N level image, wherein the clustering produces K clusters of pixel values, and wherein K=M;

repeatedly revising said K clusters of pixel values until error between the N level digital image and the M level digital image is minimized, wherein throughout the repeated revising of said K clusters, the number of clusters K does not change;

applying multilevel error diffusion to the N level digital image using said M reconstruction levels to produce the M level digital image; and

applying said M level digital image to an image output device.

17. (Cancelled)

18. (Previously Presented) The method of claim 16 wherein the first and last levels of the M levels are predetermined.

19. (Previously Presented) The method of claim 16 wherein the N level digital image has multiple channels and K-means clustering and multi-level error diffusion are performed on each of the multiple channels independently.

20. (Previously Presented) The method claimed in claim 16, wherein the N level digital image has multiple channels and K-means clustering and multi-level error diffusion are performed in multi-channel vector space.

21. (Previously Presented) A method for multitone processing an N level digital image to produce an M level digital image wherein M and N have unchanging values and M<N, comprising the steps of:

setting initial values of M cluster centers;

assigning pixels of the N level digital image to said cluster centers to provide assigned pixels;

calculating new values of said cluster centers based upon respective said assigned pixels;

repeating said assigning and calculating until a predetermined stopping condition is reached and, thereby, final values of said cluster centers are defined;

selecting said final values of said cluster centers as reconstruction levels;

applying multilevel error diffusion to the N level digital image using said reconstruction levels to produce the M level digital image; and

applying said M level digital image to an image output device.

22. (Previously Presented) The method of claim 21 wherein said assigning minimizes respective mean squared error.

23. (Previously Presented) The method of claim 21 wherein said stopping condition is a predetermined threshold.

24. (Previously Presented) The method of claim 21 wherein first and last of said reconstruction levels are predetermined.

25. (Previously Presented) The method of claim 21 wherein the N level digital image has multiple channels and said setting, assigning, calculating, repeating, selecting, and applying steps are performed independently on each of said multiple channels.

26. (Previously Presented) The method of claim 21 wherein the N level digital image has multiple channels and said setting, assigning, calculating, repeating, selecting, and applying steps are performed in multi-channel vector space.

Appendix II - Evidence

None.

Appendix III – Related Proceedings

None.